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National Bureau of Economic Research (NBER)

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# **The Cost-Effectiveness of the Army's Medium and Heavy Tactical Wheeled Vehicles in Iraq**

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National Bureau of Economic Research  
Economics of National Security  
Summer Institute 2010

## Question and Motivation

Large-scale U.S. Army policies in Iraq

- Replacing light with medium tactical wheeled vehicles
- Late 2005 through early 2008
- Replacing medium with heavy tactical wheeled vehicles
  - Late 2007 through 2008
  - ~\$35 billion spent on heavy TWV procurement

Did these major policies reduce U.S. Army fatalities?

Were they cost-effective?

## **Data**

For Official Use Only (FOUO) data from multiple Army and Defense Department sources

- Vehicle counts and mileages
  - ~20% sample of U.S. Army battalions in Iraq
  - Some measurement error in unit-level totals
- Vehicle costs
- Casualties linked to unit & location
- Unit & troop characteristics

## **Preview of Findings**

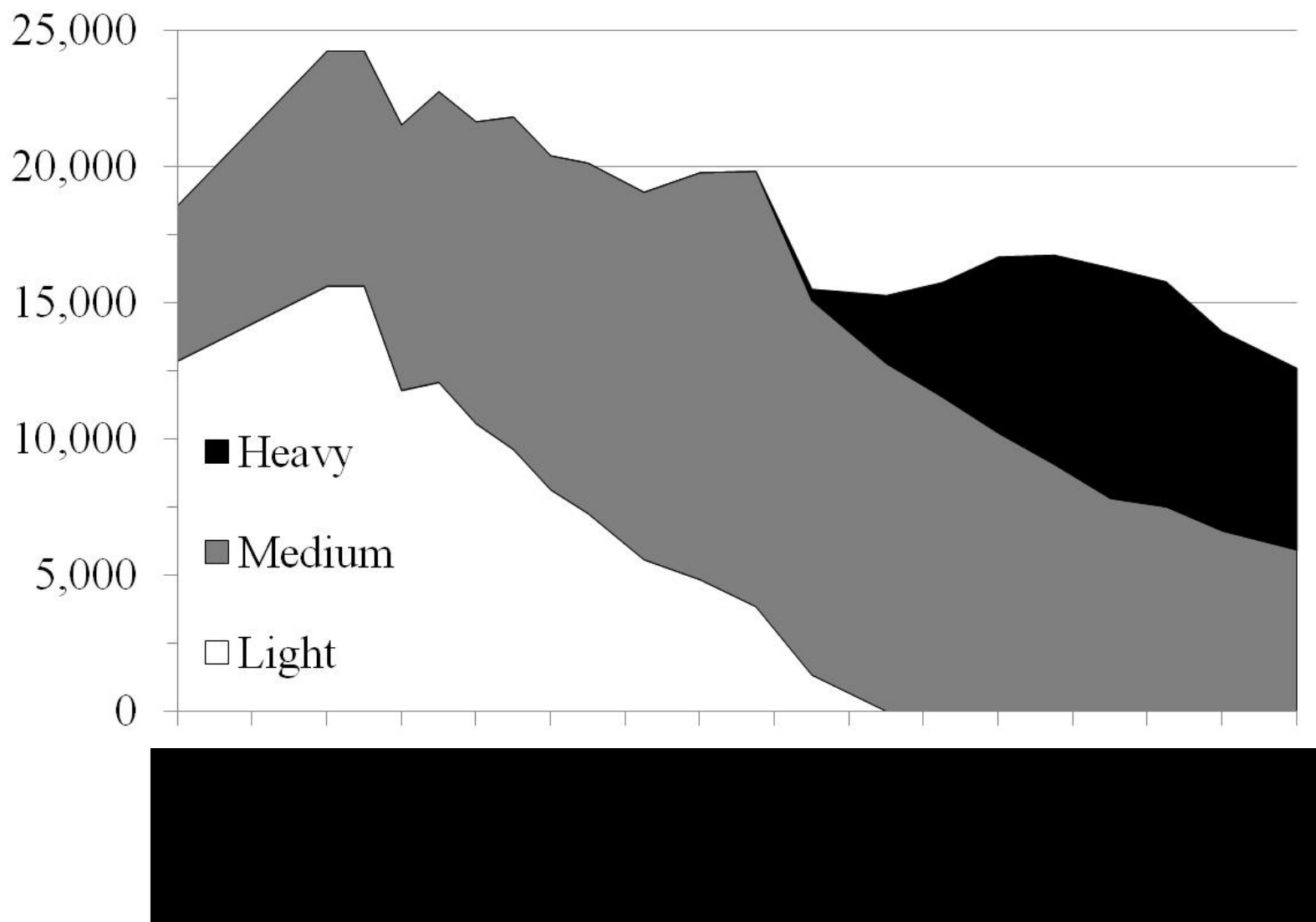
### Medium TWV phase-in

- \$1 million to \$25 million cost per life saved for infantry,
  - o Preferred estimates on the lower end
- Slightly higher cost for “other” unit types
- Not cost effective for armored & cavalry or admin & support

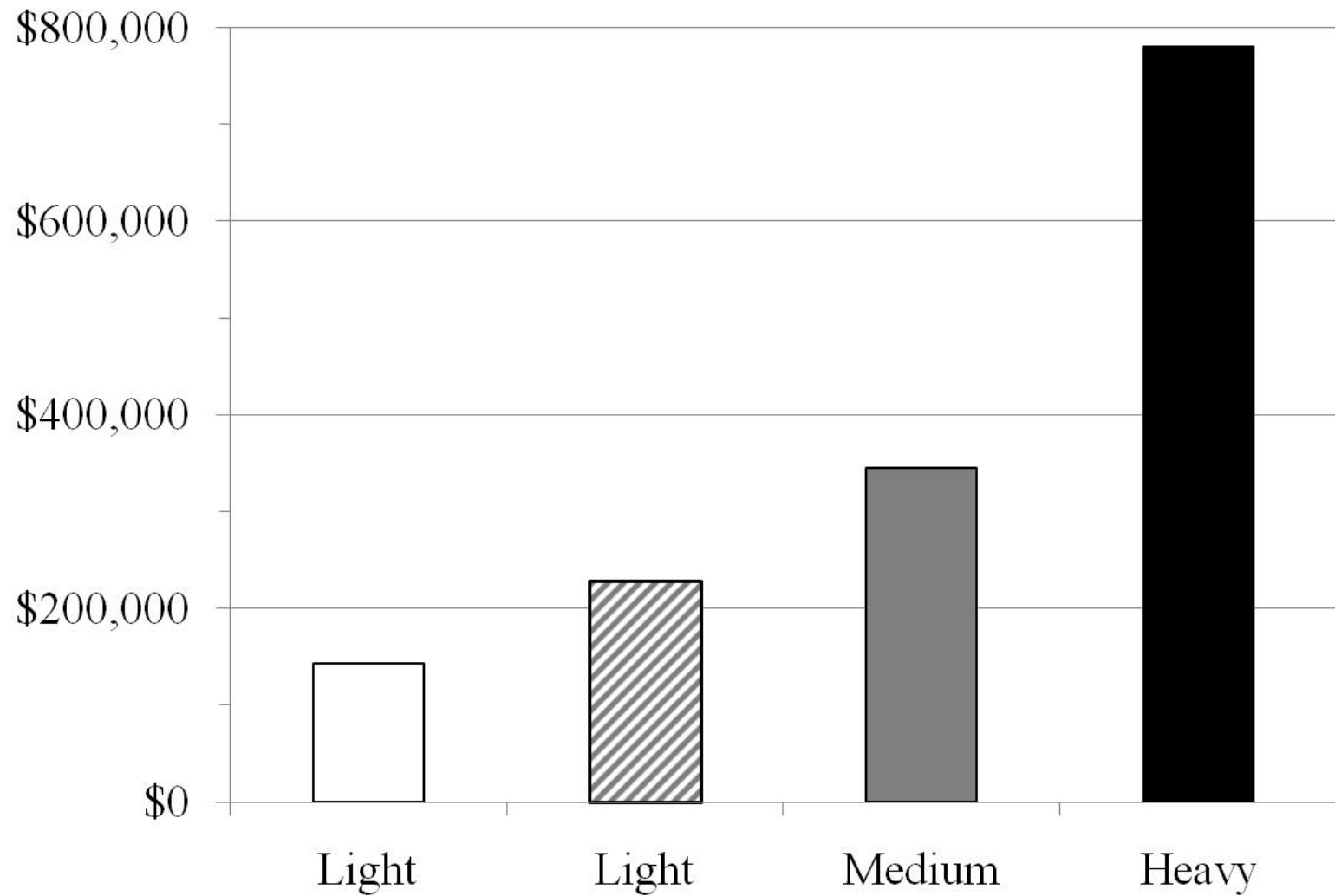
### Heavy TWV phase-in

- Provided little benefit above medium TWVs
- Not cost effective for any unit type

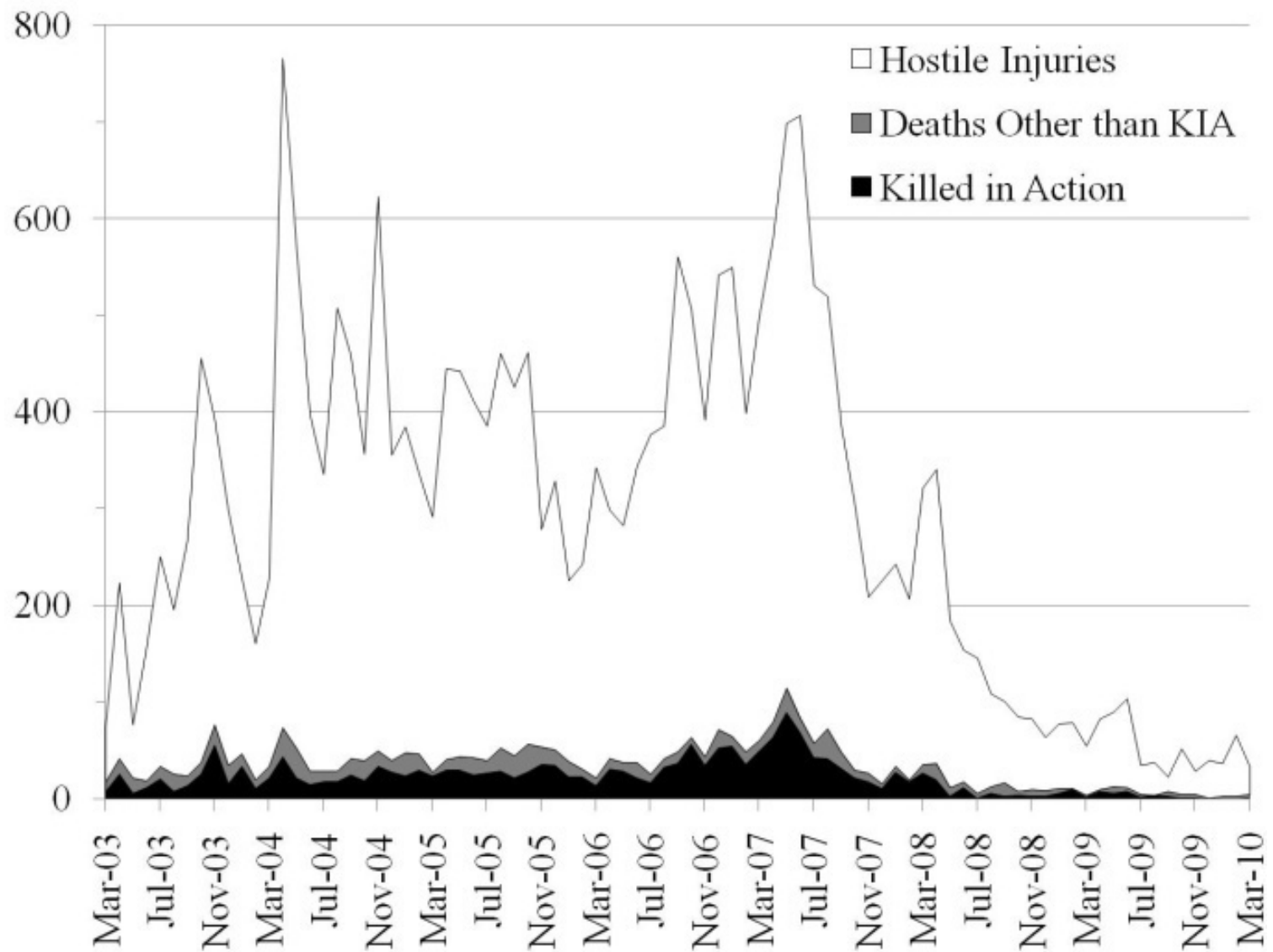
## U.S. Army TWVs in Iraq



Panel C: Estimated Average Cost by Vehicle Type



Panel E: Army-wide Casualties in Iraq





## Estimation Equations

$$fatalities_{it} = \sum_{j=1}^3 \alpha_{cj}^f * q_{jit} + \boldsymbol{\beta}_c^{f'} \mathbf{x}_{it} + \varepsilon_{it}^f,$$

$$\begin{aligned} fatalities_{it} = & (\alpha_{c2}^f - \alpha_{c1}^f) * q_{2it} + (\alpha_{c3}^f - \alpha_{c1}^f) * q_{3it} \\ & + \alpha_{c1}^f * \sum_{j=1}^3 q_{jit} + \boldsymbol{\beta}_c^{f'} \mathbf{x}_{it} + \varepsilon_{it}^f. \end{aligned}$$

Plus corresponding equations for costs, injuries, miles driven

Parameters of interest:

$$-(\alpha_{c2}^e - \alpha_{c1}^e) / (\alpha_{c2}^f - \alpha_{c1}^f) \text{ and } -(\alpha_{c3}^e - \alpha_{c2}^e) / (\alpha_{c3}^f - \alpha_{c2}^f)$$

Table 1: Pooled OLS and Fixed Effects Estimates of Effects of TWV Type on Deaths

Unit-by-Month Data, Dependent Variable is Unit-Level Deaths that Month							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Infantry Units, N = 815, Clusters = 355							
Heavy/100	-0.123 (0.035)**	-0.046 (0.032)	-0.067 (0.040)*	-0.067 (0.054)	-0.094 (0.070)	-0.306 (0.216)	-0.275 (0.233)
Medium/100	-0.075 (0.035)**	-0.044 (0.039)	-0.045 (0.042)	-0.067 (0.064)	-0.084 (0.064)	-0.357 (0.223)	-0.427 (0.227)*
Total TWVs/100	0.093 (0.033)**	0.050 (0.034)	0.054 (0.038)	0.063 (0.053)	0.057 (0.067)	0.240 (0.205)	0.308 (0.219)
R <sup>2</sup>	0.026	0.084	0.217	0.367	0.173	0.462	0.549
Panel B: Armored and Cavalry Units, N = 1213, Clusters = 518							
Heavy/100	-0.061 (0.033)*	0.050 (0.039)	0.047 (0.043)	0.034 (0.054)	0.032 (0.072)	0.107 (0.100)	0.308 (0.153)**
Medium/100	-0.026 (0.028)	0.012 (0.028)	0.011 (0.032)	-0.008 (0.044)	-0.016 (0.050)	0.059 (0.065)	0.214 (0.111)*
Total TWVs/100	0.051 (0.022)**	-0.011 (0.024)	-0.007 (0.028)	0.012 (0.040)	0.023 (0.050)	-0.034 (0.066)	-0.185 (0.110)*
R <sup>2</sup>	0.015	0.072	0.140	0.293	0.137	0.355	0.412
Panel C: Administrative and Support Units, N = 961, Clusters = 404							
Heavy/100	-0.023 (0.009)**	-0.011 (0.010)	-0.014 (0.009)*	0.000 (0.011)	0.026 (0.089)	0.050 (0.074)	0.084 (0.097)
Medium/100	0.012 (0.011)	0.002 (0.013)	-0.001 (0.014)	0.004 (0.019)	0.115 (0.090)	0.058 (0.063)	0.085 (0.097)
Total TWVs/100	0.000 (0.002)	-0.011 (0.005)*	-0.008 (0.005)*	-0.002 (0.005)	-0.084 (0.093)	-0.068 (0.073)	-0.086 (0.097)*
R <sup>2</sup>	0.001	0.038	0.169	0.499	0.149	0.648	0.689
Panel D: Other Units, N = 684, Clusters = 301							
Heavy/100	-0.056 (0.034)	-0.012 (0.033)	-0.020 (0.035)	-0.073 (0.071)	-0.155 (0.117)	-0.272 (0.219)	-0.313 (0.449)
Medium/100	-0.033 (0.036)	-0.019 (0.031)	-0.019 (0.031)	-0.075 (0.070)	-0.148 (0.114)	-0.194 (0.234)	-0.278 (0.561)
Total TWVs/100	0.034 (0.033)	0.015 (0.028)	0.016 (0.031)	0.076 (0.069)	0.160 (0.118)	0.308 (0.212)	0.364 (0.423)
R <sup>2</sup>	0.011	0.065	0.366	0.605	0.216	0.690	0.761
Controls Include . . .							
Other Vehicles		Yes	Yes	Yes	Yes	Yes	Yes
Unit Characteristics		Yes	Yes	Yes	Yes	Yes	Yes
Quadratic in Month		Yes			Yes		
Year x Month FEs			Yes				
Province FEs			Yes				
Province x Year x Month FEs				Yes		Yes	Yes
Unit FEs					Yes	Yes	Yes
Unit-Specific Trends							Yes

Table 2: Estimated Cost per Life Saved through Vehicle Substitutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Costs Presented in Millions of 2010 Dollars							
Panel A: Infantry Units, N = 815, Clusters = 355							
Heavy in place of Medium	\$15.80 (5.374)**	\$423.7 (3,793)	\$49.70 (38.65)	-\$53,067 (6.3.E+07)	\$97.80 (326.1)	-\$21.83 (32.05)	-\$7.827 (4.103)*
Medium in place of Light	\$16.18 (7.507)**	\$24.58 (21.14)	\$21.85 (19.20)	\$13.35 (9.321)	\$9.119 (6.496)	\$1.131 (0.549)**	\$1.755 (0.603)**
Panel B: Armored and Cavalry Units, N = 1213, Clusters = 518							
Heavy in place of Medium	\$40.35 (31.15)	-\$31.92 (28.56)	-\$33.48 (32.72)	-\$28.25 (23.74)	-\$24.43 (29.74)	-\$23.44 (33.28)	-\$12.51 (11.14)
Medium in place of Light	\$15.61 (16.46)	-\$35.88 (80.37)	-\$40.69 (111.3)	\$55.37 (243.2)	\$35.36 (106.0)	-\$8.905 (7.836)	-\$2.515 (1.108)**
Panel C: Administrative and Support Units, N = 961, Clusters = 404							
Heavy in place of Medium	\$0.343 (10.87)	\$10.78 (30.13)	\$18.22 (36.74)	\$69.18 (381.2)	\$10.68 (10.31)	\$125.4 (371.0)	\$1,595 (69,441)
Medium in place of Light	-\$103.1 (98.17)	\$465.6 (2,423)	\$842.7 (8,959)	-\$256.2 (961.3)	-\$4.779 (3.430)	-\$9.662 (7.236)	\$4.838 (3.462)
Panel D: Other Units, N = 684, Clusters = 301							
Heavy in place of Medium	\$19.96 (11.82)*	-\$57.58 (75.65)	\$1,506 (72,628)	-\$398.0 (2,036)	\$115.3 (256.7)	\$18.46 (8.472)**	\$48.01 (109.9)
Medium in place of Light	\$41.23 (44.10)	\$71.98 (116.1)	\$72.55 (103.1)	\$19.09 (11.73)	\$10.13 (8.669)	\$4.117 (3.193)	\$2.396 (2.259)
Controls Include . . .							
Other Vehicles		Yes	Yes	Yes	Yes	Yes	Yes
Unit Characteristics		Yes	Yes	Yes	Yes	Yes	Yes
Quadratic in Month		Yes			Yes		
Year x Month FEs			Yes				
Province FEs			Yes				
Province x Year x Month FEs				Yes		Yes	Yes
Unit FEs					Yes	Yes	Yes
Unit-Specific Trends							Yes